

case of three Arctic foxes from Iceland in the Zoological Gardens, of which "one turns perfectly white every winter, while the other two remain dark."

Cambridge, November 12.

W. F. LANCHESTER.

The Magnetic Storm of October 31.

DR. GLAZEBROOK has asked me to send you a copy of one or more of the magnetic curves during the late storm, and also of a characteristically "quiet" day. For the latter I

ment, which was partly lost on our own magnetograph, the scale of ordinates of which is more open. In this curve 1 mm. represents in the original very nearly 1' of arc, and increasing ordinate decreasing westerly declination. We had not set the clock driving this instrument quite correct, and the times shown in the trace are about four minutes wrong.

During the rapid movements the traces on the originals are faint, and consequently are not fully shown in the photographic copies sent you.

I ought to explain that the slight blurring and want of clearness on the horizontal force trace October 29-31 really arise from the electric trams. Their action, however, is hardly visible during the storm proper in either declination or horizontal force. In the vertical force, however—of which no copy is sent—the electric tram disturbance is much more considerable, and might easily be mistaken by the uninitiated for a fairly active magnetic storm.

In the accompanying illustrations, Figs. 1 and 2, 1 cm. represents practically 4 cm. of the original curves.

SUPERINTENDENT OBSERVATORY
DEPARTMENT.

The National Physical Laboratory,
Richmond, Surrey, November 7.

Expansion Curves.

IN your issue of October 8 Prof. John Perry describes in a letter "an exceedingly simple, ingenious method" of plotting the so-called polytropic curve representing the law $p v^n = \text{constant}$, which method he found in a pamphlet by Mr. E. J. Stoddard, of Detroit. I may be permitted to state that this method was published for the first time eighteen years ago by Prof. E. Brauer in the *Transactions of the Society of German Engineers*, 1885, p. 433, and since Prof. Brauer's

send copy of declination October 2-3, 1900, B₁, Fig. 2. It is not absolutely quiet—very few days are, if any—and parts show the tiny "magnetic waves" often met with. Here, as usual, there are two days' curves, each with its own base (or time) line on the same sheet. The paper is changed every second day, shortly after 10 a.m. In this quiet day declination curve, 1 cm. of ordinate in the original represents 8'.7, and increasing ordinate answers to increasing westerly declination.

The magnetic storm on October 31 commenced about four hours before the papers were changed, and the assistant in charge, noticing that a storm was in progress, arranged that the papers should be changed again next day, so as to have only one day's trace on the sheet, and so no mixing of two days' traces. As the commencement at 6.3 a.m. is of interest, I am sending two sheets of the horizontal force record, Fig. 1, the one, A₁, covering the interval October 29, 10.40 a.m., to October 31, 10.16 a.m., the other, A₂, October 31, 10.21 a.m., to November 1, 10.42 a.m. On October 31 some of the trace is off the sheet about 10 a.m., also between 2 and 4 p.m. and between 5 and 7 p.m. The time or base line answers to an arbitrary value (determined by the absolute observations), and 1 cm. of ordinate in the original curve represents 50 γ (where $1 \gamma = 1 \times 10^{-5}$ C.G.S.), increasing ordinate representing increasing force.

I also send a copy of part of the declination record, B₂, Fig. 2, given by a Watson pattern magnetograph made by the Cambridge Instrument Company, sent to the Laboratory for test. The original shows, I think, all the move-

ment, which was partly lost on our own magnetograph, the scale of ordinates of which is more open. In this curve 1 mm. represents in the original very nearly 1' of arc, and increasing ordinate decreasing westerly declination. We had not set the clock driving this instrument quite correct, and the times shown in the trace are about four minutes wrong.

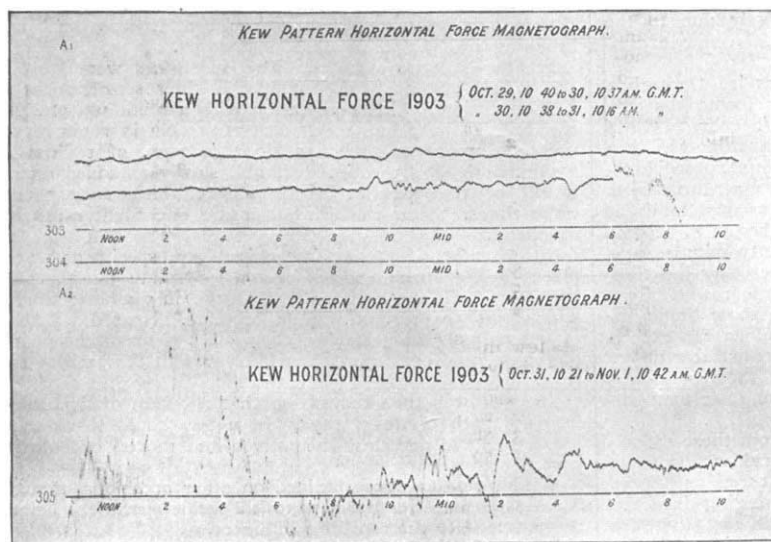


FIG. 1.—Reduced Registers of Horizontal Force.

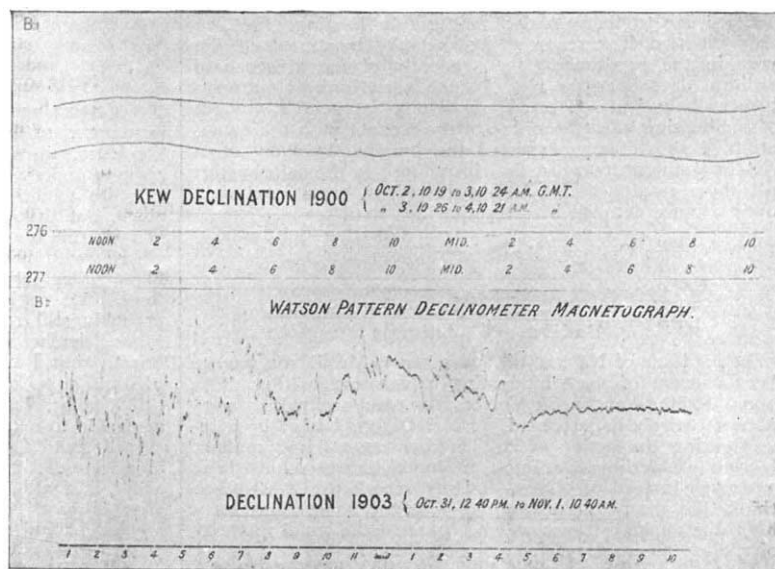


FIG. 2.—Reduced Registers of Declination.

publication this method has been used in a number of treatises on thermodynamics published in Germany and France. It has been given for years in the very valuable handbook "Huetten," which is undoubtedly known to Prof.

Perry. Is it not surprising that a method which Prof. Perry himself considers very important should have to reach England from Germany by the circuitous path of the United States?

The reorganisation of technical education in England has occupied the wisest men in England for the past thirty years. It seems to be of so much importance that it has been made the subject of Sir Norman Lockyer's recent presidential address before the British Association. It seems to me that a plea might well be made for the acquisition of a reading knowledge of modern languages, especially French and German, in the advanced public schools. Prof. Perry re-discovered in an American paper, eighteen years after its first publication, a very important method for constructing a curve continually used in thermodynamics. Nineteen years ago Prof. Herrmann originated and described the entropy diagram, so often attributed to Mr. Macfarlane Gray, through whose admirable paper, read in 1889, the entropy diagram has since come into general use. There are a number of similar cases which might be cited in favour of the cultivation of a reading knowledge of those modern languages which are apt to contain valuable contributions to scientific knowledge. Forty-three years ago Prof. Huxley wrote, "What is it that constitutes and makes man what he is? What is it but his power of language—that language giving him the means of recording his experience—making every generation somewhat wiser than its predecessor—more in accordance with the established order of the universe? What is it but this power of speech, of recording experience, which enables men to be men. . . ." We might paraphrase Huxley's words and apply them to the advantage that a knowledge of the modern languages gives its owner in regard to utilising the experience of other men and nations.

B. A. BEHREND.

Station H, Norwood, Cincinnati, Ohio, October 26.

It was of very little importance to me to find out whether the method was new; the important thing was that it was not generally known in England, that I, who read a good deal, had never seen the method, and that many of my friends who read French and German engineering books more than I do had never seen it. I may say without any contrition that there are useful things not only in French and German, but in Italian, Russian, and Chinese, as well as in English books unknown to me and to many other people, but surely this is not enough for an argument for the absolute necessity for a study of Chinese or German. Before our "advanced public schools" take up the study of French and German or Chinese, I should like to see them take up the study of English. In America and Scotland English is really well taught in many schools; this is not the case in England.

J. PERRY.

November 11.

The Leonid Shower of 1903.

QUITE an abundant and attractive display of Leonids was observed here this morning (Monday, November 16). I began to watch the north-eastern sky at midnight (following November 15), and found meteors increasingly numerous. After 2 a.m. November 16, the numbers appearing in alternate intervals of fifteen minutes were as follows:—

Nov. 16	h. m.	h. m.	Leonids
2	0 to 2	15 a.m.	10
3	30 to 3	45 "	14
3	0 to 3	15 "	13
3	30 to 3	45 "	13
4	0 to 4	15 "	26
4	30 to 4	45 "	34
5	0 to 5	15 "	28
5	30 to 5	45 "	42
6	0 to 6	15 "	21

The horary rate of apparition for one observer was approximately as under:—

	Leonids
0 to 1 a.m.	16
1 to 2 "	20
2 to 3 "	48
3 to 4 "	52
4 to 5 "	120
5 to 6 "	140

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Maximum 5h. 30m. to 5h. 45m. a.m., when the rate was nearly three per minute.

The position of the radiant point was at $151^{\circ} + 22^{\circ}$, and it formed an area about 6 degrees in diameter. The great majority of the meteors, however, diverged accurately from the central part of the area.

During the minute following 3h. 44m. a.m. five Leonids appeared.

The meteors generally were very bright, and comparatively few were seen fainter than second magnitude. The more conspicuous objects were as follow:—

Nov. 16	Mag.	From	δ	α	To	δ
h. m.		α				
0 36	...	1	...	122	+	24½
1 13	...	1	...	119½	...	48
2 36	...	Sirius	...	117½	...	26½
2 43	...	1	...	162	...	38½
2 44	...	2	...	73	...	72½
4 4	...	1	...	168½	...	37
4 12	...	2	...	70	...	70
4 37	...	2	...	138	...	35
4 45	...	2	...	92	...	53
4 45	...	2	...	138	...	12
5 11	...	1	...	213	...	29
5 14	...	2	...	173	...	40½
6 5	...	2	...	182	...	51
						103
						23½
						97
						53½
						98
						26½
						168
						44
						17
						63
						186
						45
						19
						59
						133
						39
						68
						52½
						134
						7½
						223
						27
						190
						47
						195
						55½

A few meteors were noticed from minor showers, two particularly interesting objects being:—

a.m.	h. m.					
3 41	...	4	...	219	+	63
3 59	...	2	...	178	...	19
						209
						61½
						223
						41

These moved very slowly, and probably belonged to radiant at $262^{\circ} + 62^{\circ}$ and $147^{\circ} - 11^{\circ}$ respectively.

I should be glad to hear of duplicate observations of any of the above, as it is desirable to compute their real paths if the necessary materials can be obtained.

Bristol, November 16.

W. F. DENNING.

Autophyllogeny in the Vine (Vitis).

I LATELY received from a neighbour a vine-leaf, taken from his own garden, exhibiting the uncommon phenomenon known as "autophyllogeny." A small green leaf had arisen from the midrib, near the apex of the central lobe, upon the upper surface of the leaf. The supernumerary leaf was sessile, and had its upper surface turned towards the corresponding surface of the primary leaf, in the same direction of growth. The leaflet appeared to be of the normal shape, but, owing to a slight malformation, it was not fully expanded, and I could not therefore entirely satisfy myself upon this point.

Dr. Masters, in his "Vegetable Teratology," cites instances in which supernumerary leaflets have been observed upon the upper surfaces of leaves of *Heterocentron* and *Miconia*, and upon the under surfaces of leaves of other plants, but I cannot find any record of their occurrence in the vine.

HERBERT CAMPION

Walthamstow, Essex.

The "Dew-bow."

ON Wednesday and Thursday, November 4 and 5, fogs prevailed in this district and brought by mild winds great quantities of carbonaceous dust from over the town, which covered the surface of the top pond in Vernon Park with a dry film. On the morning of Friday, November 6, hoar frost covered the grass and walks; the film of dust on the pond was covered with a glistening coat of minute watery globules. At 11.20, standing with my back to the sun, I noticed a bright streak of light on the surface of the water, and on moving a few feet further saw that it was split up into the colours of the prismatic spectrum, and presented the appearance of the rainbow, as it appeared curved. There were two spectra, one fainter than the other. The phenomenon was visible for more than four hours, and I directed the attention of several gentlemen to it. In November, 1885, Mr. Thomas Kay, Moorfield, Stockport, saw a similar phenomenon on Lake Windermere, and pub-